

Service Manual

Biomedical Freezer MDF-U730M

FILE No.

SANYO Electric Co., Ltd.
Biomedical Business Division



! **RoHS**

This product does not contain any hazardous substances prohibited by the RoHS Directive.
(You will find 'RSF' mark near the rating plate on the RoHS compliant product.)

! **WARNING**

- * You are requested to use RoHS compliant parts for maintenance or repair.
- * You are requested to use lead-free solder.

Effective model

This service manual is effective for following model.

Model name	Product code	Voltage and Frequency
MDF-U730M	823 010 54	220/230/240V 50Hz

Contents

	Page
Features -----	1
Specifications -----	2
- Structural specifications	
- Control specifications	
- Performance specifications	
Dimensions -----	5
Refrigeration circuits -----	6
Connections on PCB -----	7
Electric parts -----	8
Specifications of sensor -----	9
Wiring diagram -----	10
Circuit diagram -----	11
Control specifications -----	12
Test data -----	15
- Pull-down and pull-up data	
- Pressure data	
- Current and power consumption data	
- Temperature uniformity – 15points measured	
Instruction Manual -----	19

Features

■ Cooling performance

Refrigerant circuit contains HFC refrigerant that effects to environment little.

Latest cooling system reduces negative factor to global environment. With ambient temperature shown at 35°C, while chamber temperature maintains -30°C.

■ Easy operation

* New type door handle makes an operator's strength less to open the door.

* Levels of shelves are adjustable.

* 2" storage container (MDF-T07ST) for optional components

■ Environmental friendly

* HCFC free refrigerant R-404A is used in the refrigeration circuit.

* CP urethane foaming for insulation (HCFC free)

Specifications

■ Structural specifications

Item	MDF-U730M
Name	Biomedical Freezer
External dimensions	W770 × D830 × H1955 (mm)
Internal dimensions	W650 × D710 × H1520 (mm)
Effective capacity	690 L
Door	1, painted steel
Insulation	Rigid polyurethane foamed-in place
Exterior	Painted steel
Interior	Painted steel
Shelf	4, polyurethane coated wire Size; W626 x D620 (mm) Max. load; 50kg/shelf
Door latch	1 on the left side (padlock attachable)
Door lock	1 on the upper side
Door handle	1 on the left side
Caster	4
Fixture	2 on the back side
Access port	1 port on the left side, 1 port on the top of unit Diameter; ϕ 30mm
Refrigeration circuit	Primary cooling system
Compressor	Hermetic type, Output; 400W
Evaporator	Tube on sheet type
Condenser	Wire and tube type
Refrigerant	R-404A
Refrigerant oil	E-68NT1
Power supply	Local voltage
Weight	150 Kg
Accessories	1 set of key, 1 scraper, 2 large & 2 small nylon clips (for temperature recorder)
Optional component	Automatic temperature recorder (MTR-G85) + Mounting kit (MPR-S7) Automatic temperature recorder (MTR-4015LH) + Mounting kit (MPR-S30) 2 sets of basket (MDF-T07SC), 3 sets of shelves (MDF-T07ST)

■Control specifications

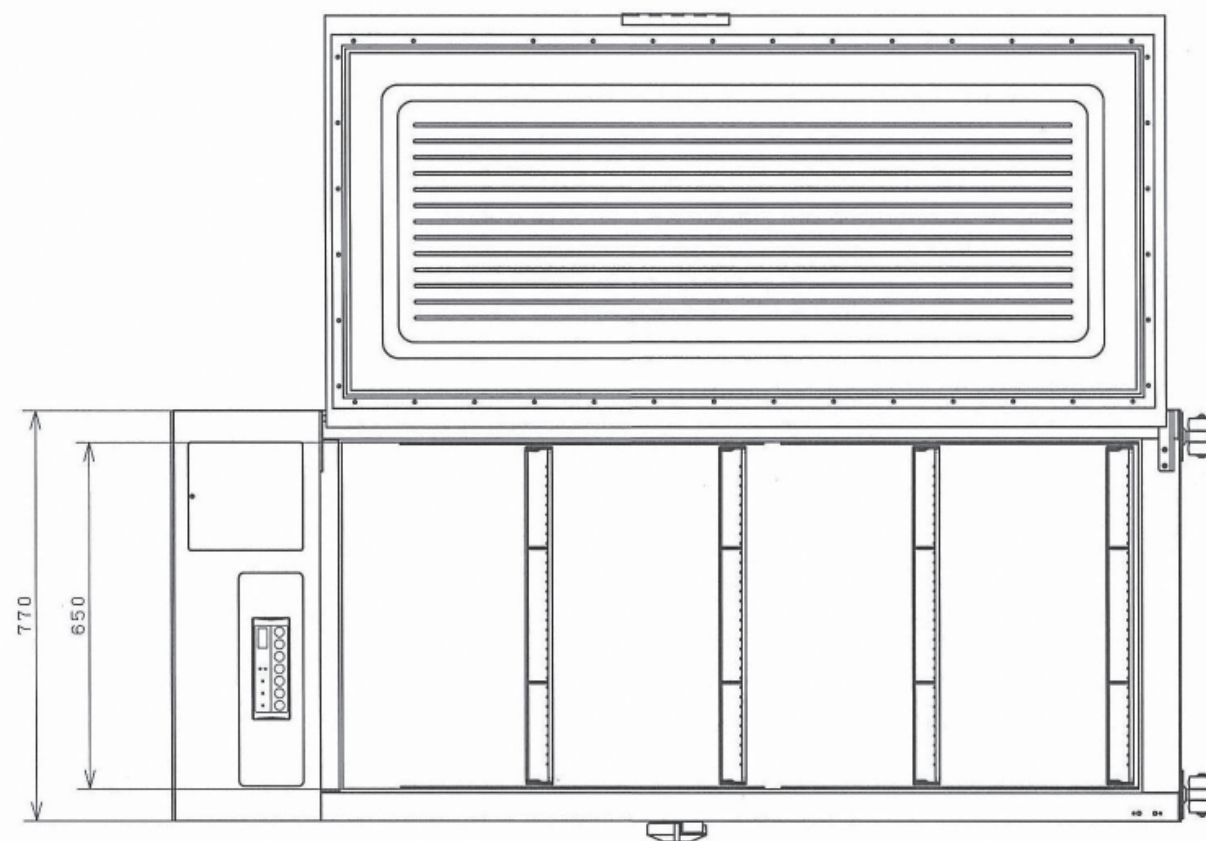
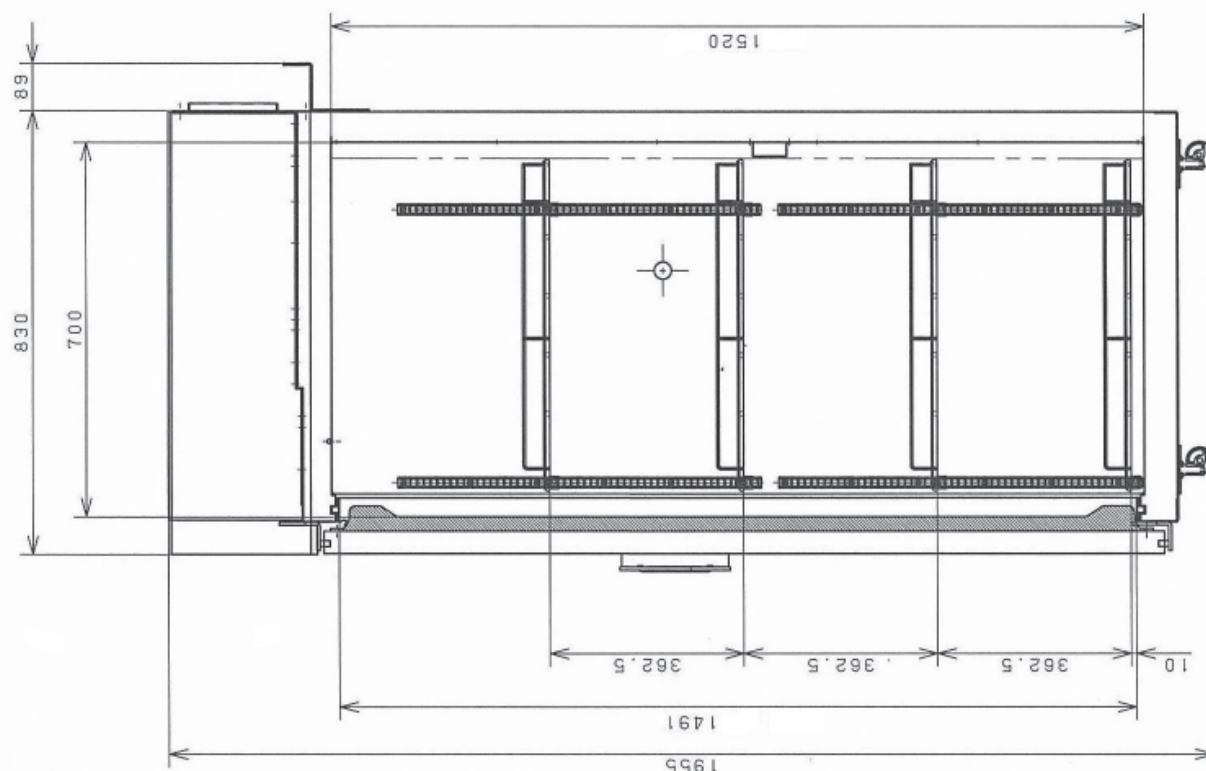
Item		MDF-U730M
Temp. controller		Microcomputer control system Temperature setting range: -18°C~-35°C (Unit; 1°C) Temperature control range: -20°C~-30°C Non-volatile memory Temperature default setting: -30°C
Temperature sensor		Thermistor sensor
Temperature display		LED digital display Display range: 0°C~-40°C (Unit; 1°C) Note) 'HI' is displayed when the temperature is equal or higher than 1°C. 'LO' is displayed when the temperature is equal or lower than -41°C.
Alarms	Temperature	+5°C~+15°C for High temperature alarm (Default; +10°C) -5°C~-15°C for Low temperature alarm (Default; -10°C) ALARM lamp blinks and buzzer sounds intermittently with 15min. delay. Remote alarm activates.
	Door	DOOR lamp is lit and buzzer is emitted with 2min. delay.
	Power failure	ALARM lamp blinks, buzzer sounds intermittently and remote alarm activates. Temperature display is gone off. (Present chamber temperature is displayed for 5 seconds with BUZZER key pressed.)
	Remote alarm	Remote alarm terminal 3P; Max. DC30V、2A NC-COM, NO-COM
	Compressor abnormal temp.	Buzzer sounds intermittently.
Control panel		Lamps: ALARM, DOOR Alarm buzzer stop key: BUZZER Alarm test key: ALARM TEST Defrost key: DEF Set key: SET Digit shift key: ►► Numerical value shift key: ▲
Key lock function		Press ►►key for 5 seconds to display; L0: Key lock is off L1: Key lock is on
Sensor abnormality		When any failure is occurred in sensor, ● Error code and 'HI' or 'LO' are alternately displayed ● Remote alarm activates ● Buzzer sounds intermittently
Compressor protection		Overload relay and compressor protection cycle

■Performance specifications

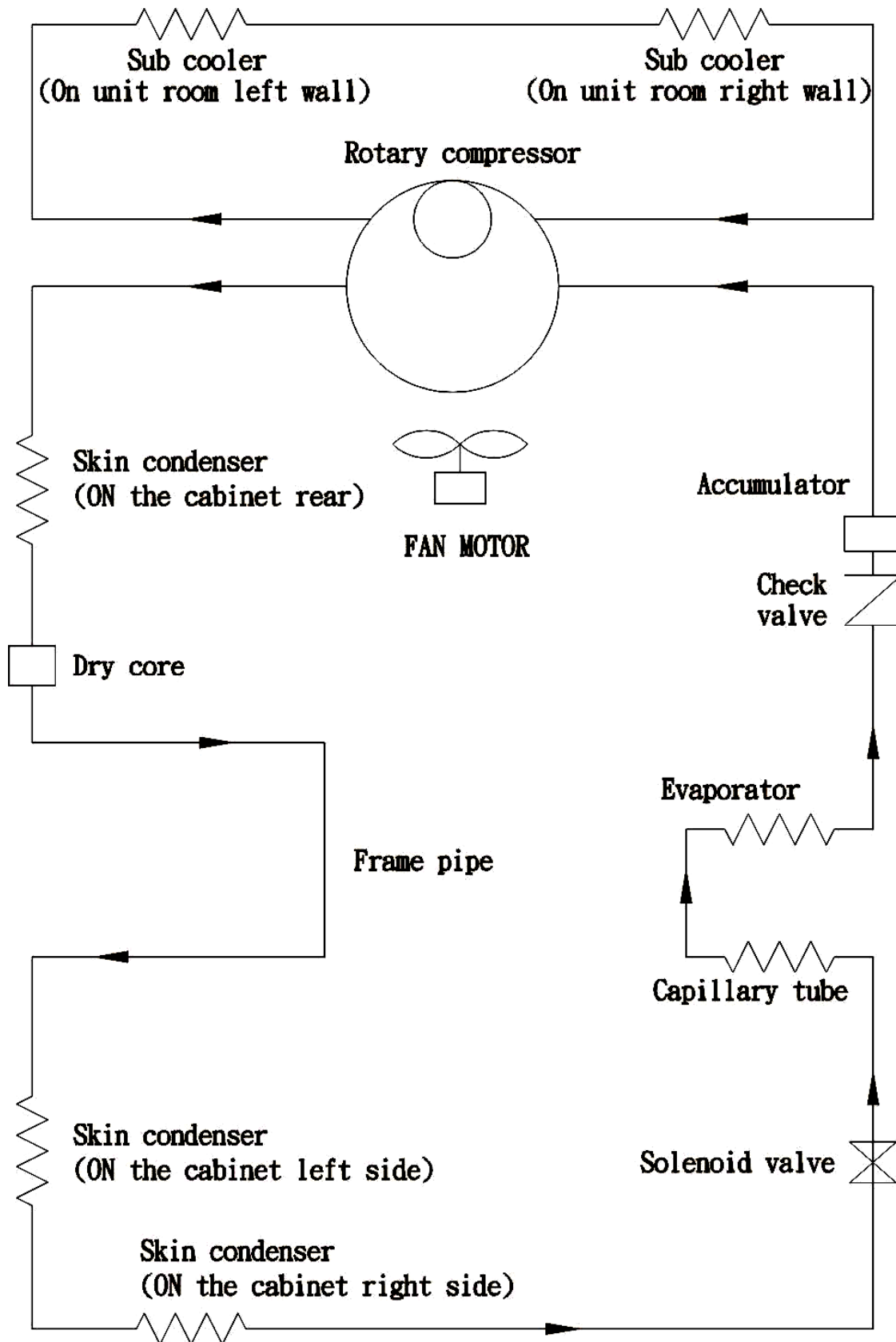
Cooling performance	-20°C~-30°C (AT5°C~35°C, no load)
Rated power consumption	260W/280W (230V/240V)
Noise level	42 dB {A} (background noise 20dB)
Maximum pressure	2.78 MPa
Maximum power consumption	365W/390W (230V/240V)
Maximum current	2.3A/2.6A (230V/240V)
Usable conditions	AT; +5°C~+35°C Humidity: Less than 80%RH

* Design or specifications will be subject to change without notice.

Dimensions



Refrigeration circuit



Connections on PCB

The following shows connections of connector on Temp. Control PCB.

Connector	Connects to	Usage
CN1	#1: Comp. relay #4: Solenoid valve #5: Breaker switch	To control compressor on/off
CN2	#1 - #2: Comp. relay	To control compressor on/off
CN3	Modular terminal blocks #1: N.O. #2: COM #3: N.C.	Remote alarm contact outputs. In normal condition, open for #2-#1 and closed for #2-#3.
CN5	#1 - #5: Display PCB	To connect to each LED.
CN6	#1 - #12: Display PCB	To connect to each LED.
CN7	#3 - #4: F sensor #5 - #6: Door switch	To detect temperature in outlet pipe To detect door ajar
CN8	#3 - #4: Comp. sensor	To detect temperature in compressor

Electric parts

MDF-U730M		220/230/240VAC, 50Hz
Compressor	Type	C-2SN400L5W
	Code	807 780 25
	Rated voltage (50/60Hz)	220-240V, 50Hz
	Winding resistance C-S(Main)	6.251 Ω
	C-R(Aux)	18.79 Ω
Starting relay	Type	AMVL-300A
	Pick up voltage	185~217VAC(50Hz)
	Drop out voltage	60~120VAC(50Hz)
Overload relay	Type	P12MUF
	Action to the temp. (no current)	ON: 130 \pm 8 $^{\circ}$ C OFF: 69 \pm 10 $^{\circ}$ C
	Action to the current (AT25 $^{\circ}$ C)	12A
	Operation time	6~15 sec.
Starting capacitor	Rating	300VAC, 30MF
Running capacitor	Rating	400VAC, 4MF
Condensing fan motor	Type	FL2-C021R5MP
	Rating	230VAC, 2W
Breaker switch	Type	BAM215131
	Rating	250V, 15A
Power cord	Type	GTVD-2,3
	Rating	16A, 250V
Solenoid coil	Type	NEVAC240V
	Rating	240VAC, 50/60Hz
Comp.relay	Type	852-W-1A-C1
	Rating	12VDC

Specifications of sensor

The following shows temperature and resistance characteristics on thermal sensor.

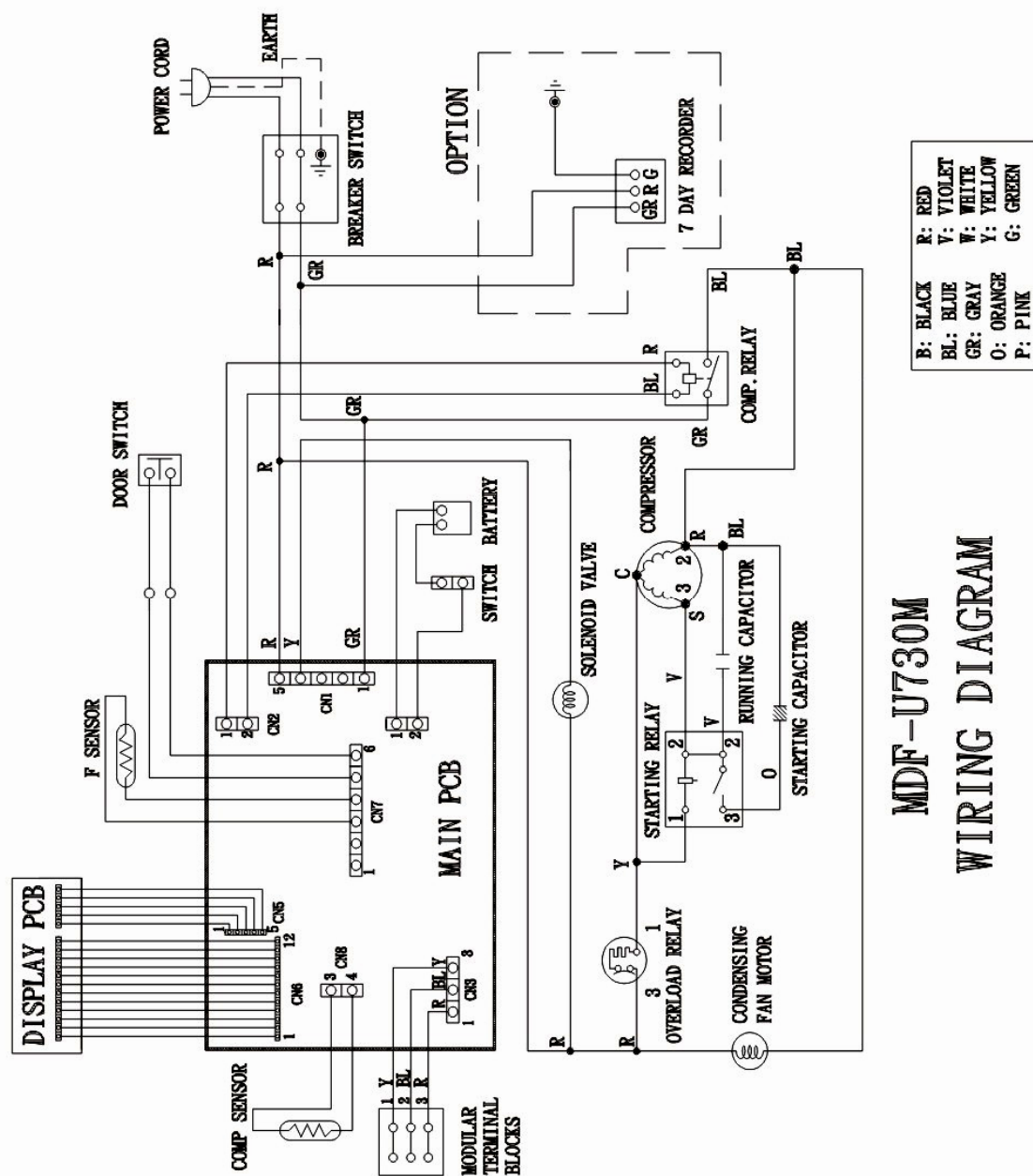
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Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
-40	49.220	-25	21.085	-10	9.681
-39	46.411	-24	19.977	-5	7.578
-38	43.776	-23	18.932	0	5.972
-37	41.305	-22	17.948	5	4.739
-36	38.935	-21	17.020	10	3.784
-35	36.808	-20	16.146	15	3.041
-34	34.764	-19	15.320	20	2.459
-33	32.843	-18	14.541	25	2.000
-32	31.039	-17	13.806	30	1.635
-31	29.343	-16	13.112	35	1.345
-30	27.749	-15	12.457	40	1.112
-29	26.249	-14	11.837	45	0.924
-28	24.839	-13	11.252	50	0.771
-27	23.511	-12	10.699		
-26	22.262	-11	10.176		

<Type: SS128-203H397G-4610>

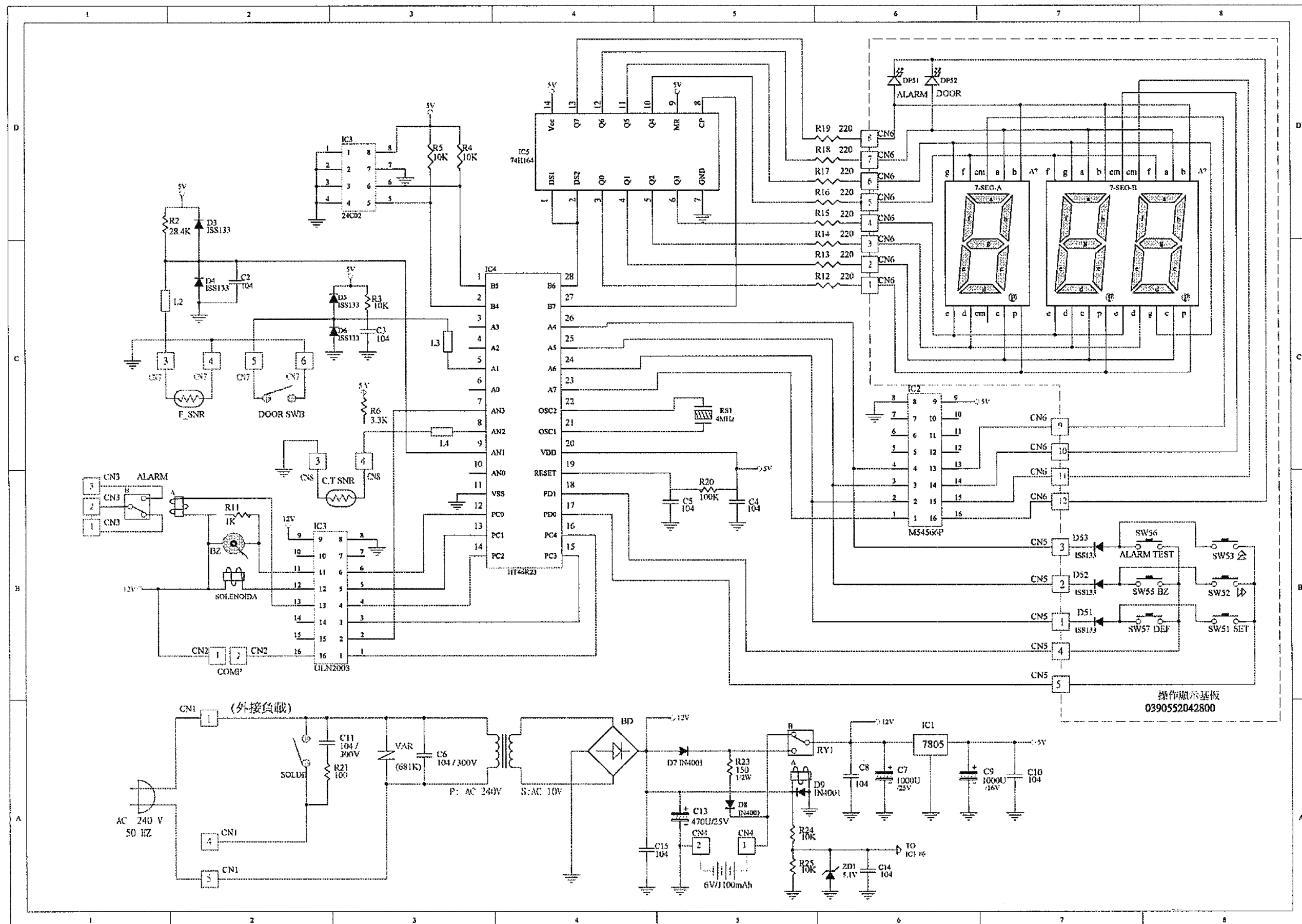
Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)	Temperature (°C)	Resistance (kΩ)
0	65.56	75	29.66		
5	50.93	80	25.19		
10	39.88	85	21.49		
15	31.46	90	18.40		
20	25.00	95	15.82		
25	20.00	100	13.66		
30	16.11	105	11.83		
35	13.05				
40	10.64				
45	87.30				
50	72.00				
55	59.70				
60	49.76				
65	41.68				
70	35.08				

Wiring Diagram





MDF-U730M
WIRING DIAGRAM

Circuit Diagram





Control specifications



1. Key and Switch

- BUZZER** : During alarm condition, press this key to stop buzzer sounding and remote alarm does not activate.
During power failure and sensor error, remote alarm keeps activating even though you press this key.
- ALARM TEST** : With this key pressed to activate alarm test mode to be forcibly step into alarm condition. Buzzer and remote alarm are forcibly activated.
Press this key again to cancel alarm test condition.
- SET** : Press this key once to activate set mode, press the key again to store the value to be changed.
- DEF** : Press this key for 5 seconds to start defrosting.
-  (Digit shift key) : During setting mode, the blinking digit shifts among the 1st digit or the 2nd digit or 3rd digit.
-  (Numerical value shift key) : During setting mode, count the blinking digit up every pressed this key.

2. Temperature control

- Setting range** : -18°C ~ -35°C (Unit; 1°C)
- Control range** : -20°C ~ -30°C
- Display range** : 0°C ~ -40°C
- 'HI' ... Chamber temperature is 1°C or higher
- 'LO' ... Chamber temperature is -41°C or lower
- Setting procedure** : Press SET key and set the required value with  key and  key.
Press SET key to store the set value.

3. Key Lock mode



- Setting range** : 0 or 1
- Setting procedure**: In chamber temperature display, keep pressing  key over 5 seconds to enter into Key Lock mode with buzzer sounds.
Change the value with  key and press SET key to store the value in the non-volatile memory.

4. Temperature offset

- For temperature zero calibration for temperature sensor, press  key for 5 seconds.
Set value among -9°C~+9°C(Unit; 1°C) by  key pressed.

5. Temperature alarm

- Setting range** : High temperature alarm ... +5°C~+15°C (Default setting: 10°C)
Low temperature alarm -5°C~-15°C (Default setting: -10°C)
- Timing** : <High temperature alarm>
When chamber temperature is higher than set temperature + 5~15°C, ALARM lamp is lit and buzzer sounds with 15 minutes of delay.
Remote alarm activates.
- <Low temperature alarm>
When chamber temperature is lower than set temperature - 5~15°C, ALARM lamp is lit and buzzer sounds with 15 minutes of delay.
Remote alarm activates.

Setting procedure : Keep pressing  key and  key over 5 seconds to enter into setting mode for temperature alarm (F00). Set "F01" for high temperature alarm or "F02" for low temperature alarm. Press SET key to set the value to be changed with the 1st digit blinks. Press SET key again to store the value in the non-volatile memory.

- Note)
- Temperature alarm does not activate when unit starts operating and defrosting.
 - Temperature alarm activates after the compressor stops once.

6. Power failure alarm

ALARM lamp blinks, buzzer sounds, remote alarm activates and the display is gone off during power failure.

If you press BUZZER key, buzzer stops sounding and the current chamber temperature is displayed for 5 seconds.

Any other keys but BUZZER key are inoperative.

For the compressor protection, compressor starts operation with delay after the power retrieves within 4 minutes since the power was failed.

7. Door alarm

When the door is ajar, DOOR lamp is lit.

After 2 minutes elapse since the door ajar, the buzzer sounds.

Remote alarm does not activate.

8. Compressor temperature abnormality

When temperature in compressor sensor is over than 95°C for 2 seconds, compressor stops operation with buzzer sounds and remote alarm activates.

When temperature in compressor sensor is equal or lower than 60°C, compressor starts operation again and buzzer stops sounding.

9. Thermal sensor abnormality

When thermal sensor is failed, error code is displayed, buzzer sounds and remote alarm activates. Compressor is kept operating.

When thermal sensor is short circuited, E01 and 'HI' are alternately displayed.

When thermal sensor is open circuited, E01 and 'LO' are alternately displayed.

10. Defrosting

Press DEF key for 5 seconds to start defrosting with buzzer sounds. Compressor stops operation. Current chamber temperature and 'dF' are alternately displayed.

During defrosting or after defrosting completes, press DEF key for 5 seconds to stop defrosting and start unit cooling.

For the compressor protection, compressor starts operation with 4 minutes of delay even though defrosting is forcibly done.

11. Auto return function

If there is not any key operation for 90 seconds during setting mode, unit automatically reverts to chamber temperature display without the setting value memorized.

12. Compressor delay time

<After the power is supplied>

The compressor starts operation with 9 seconds of delay since the power is supplied.

<During cycle operation>

When the unit is in cycle operation, the compressor does not start until 4 minutes elapse once the compressor stops operation.

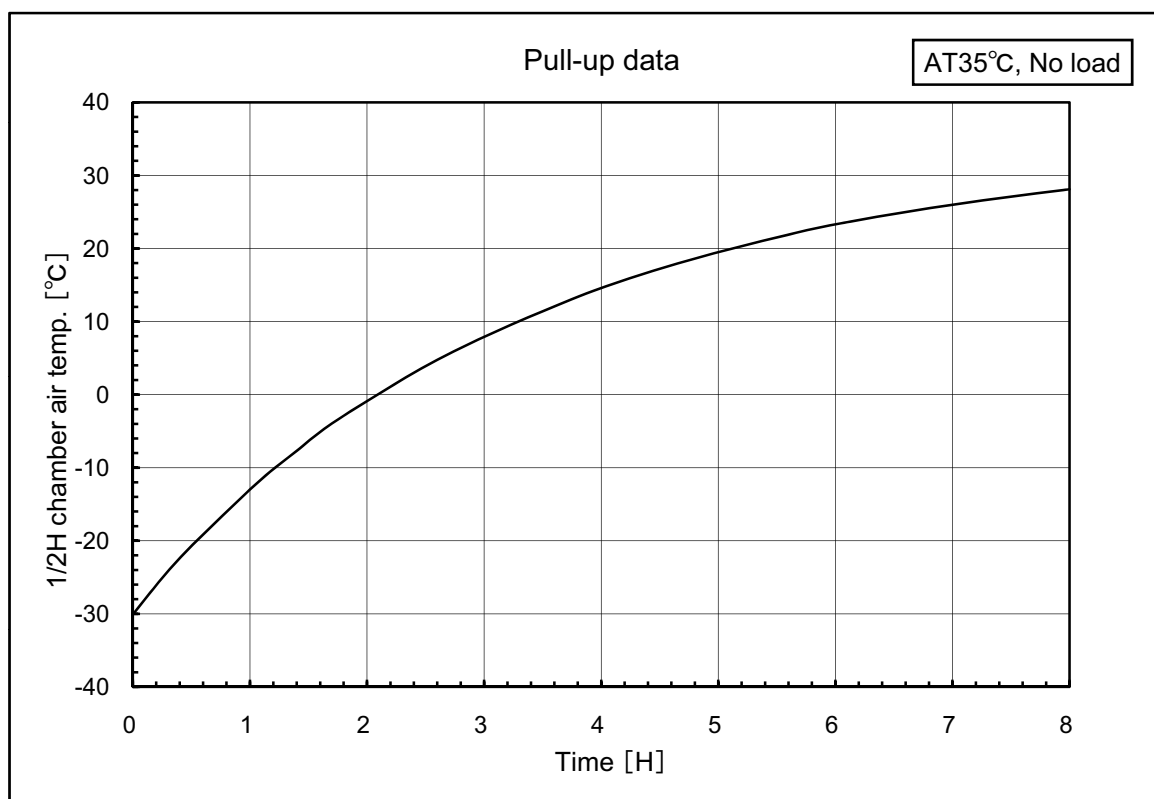
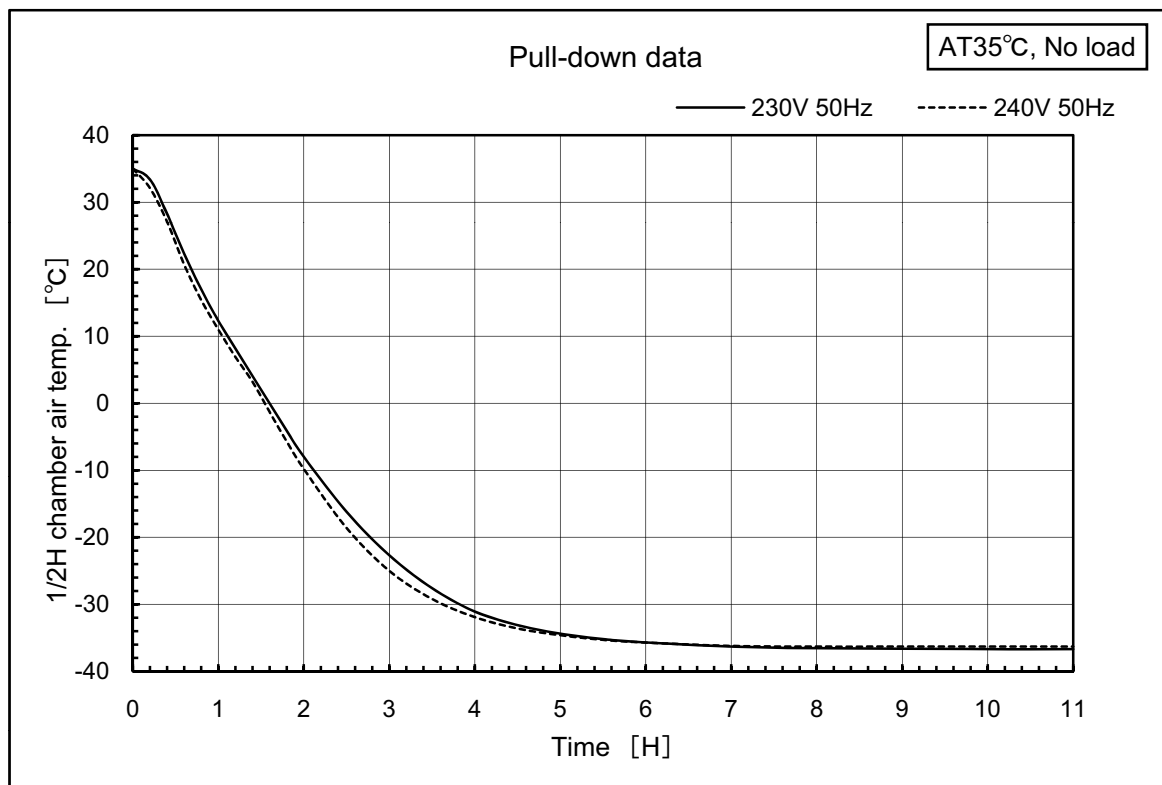
13. Temperature to control compressor

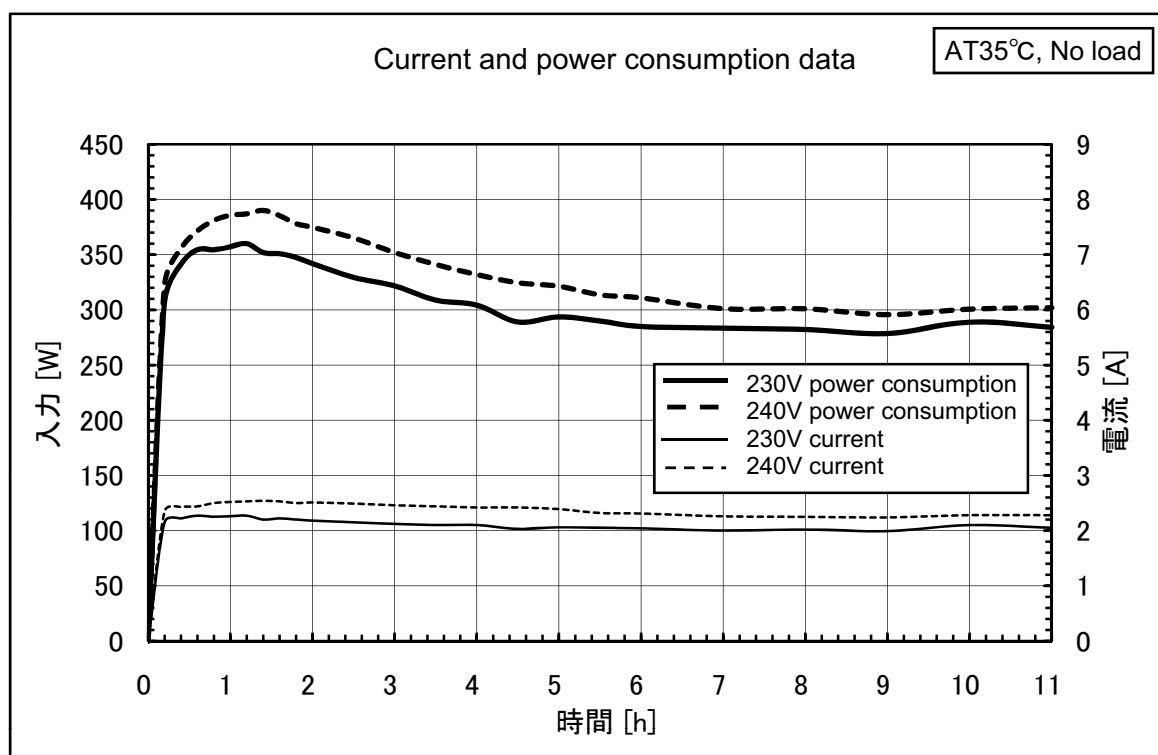
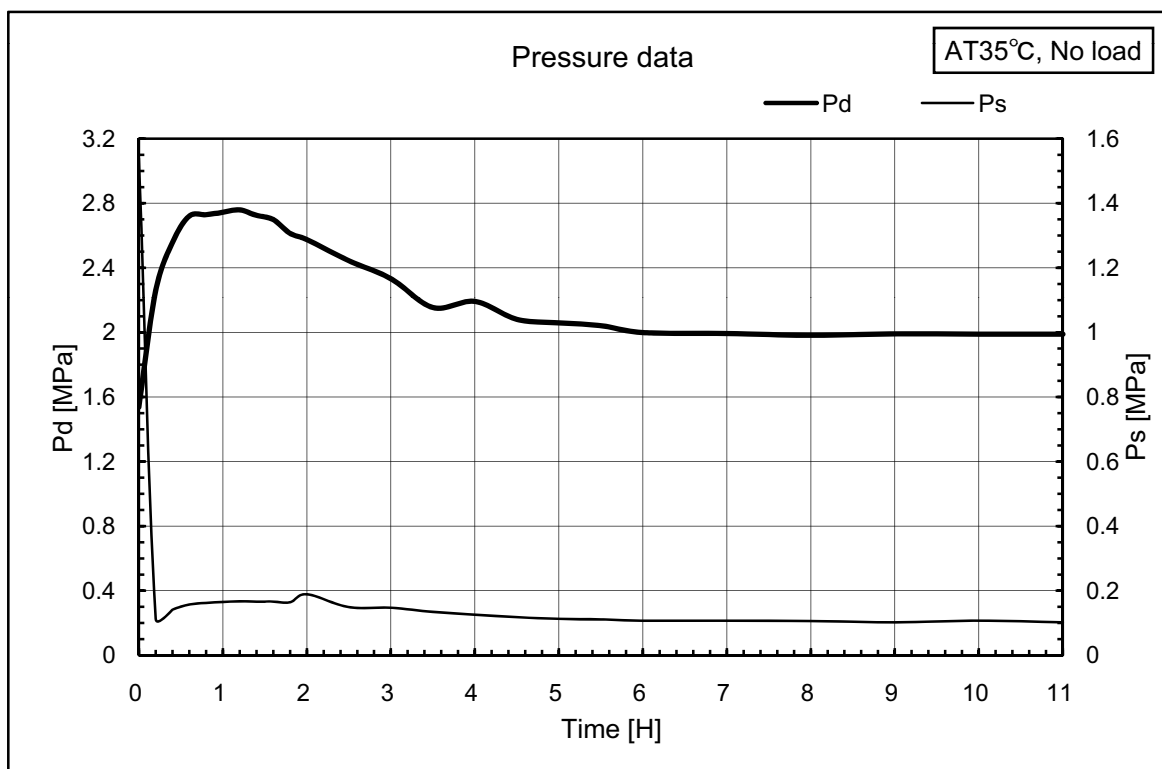
When chamber temperature is reached to set temperature + 0.3°C, compressor starts operation.

When chamber temperature is reached to set temperature – 0.3°C, compressor stops operation.

Test data

* All the data are the reference only.



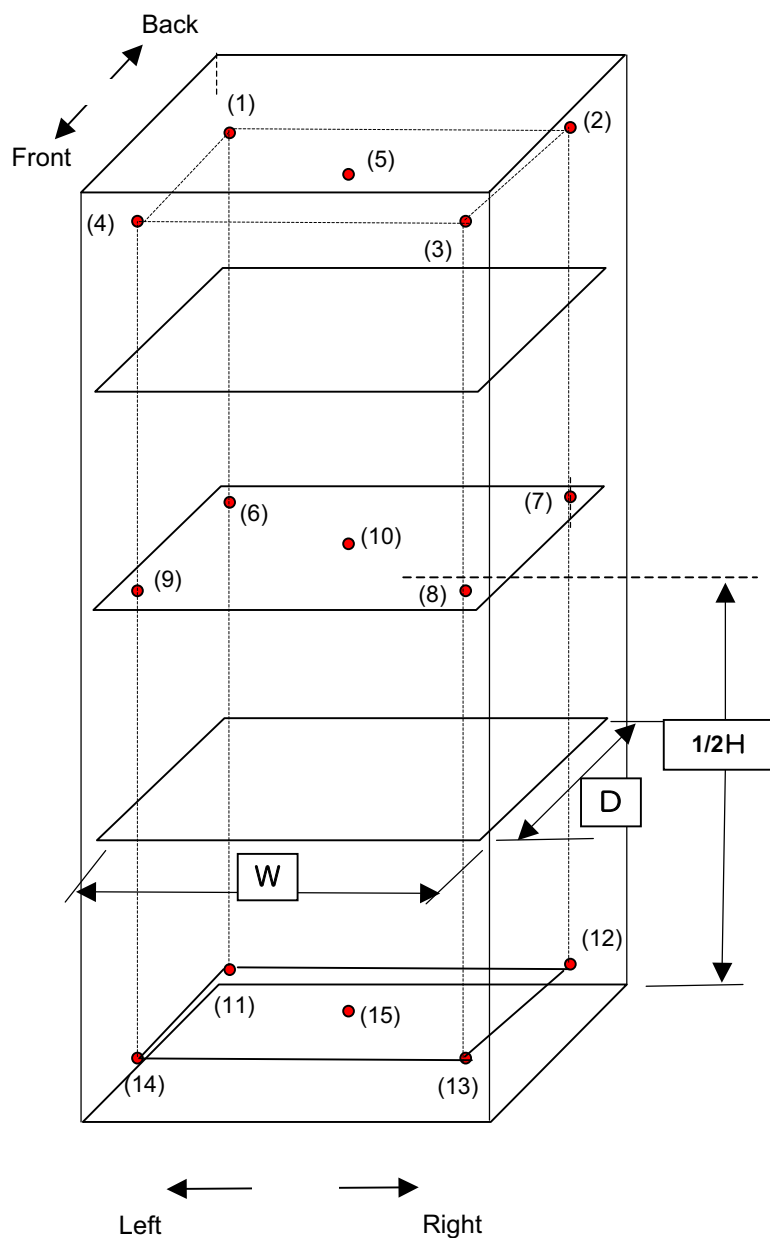


Temperature uniformity data (15 points measured)

*Following data are the reference only.

<Test conditions>

- Power source: 230V50Hz
- AT: 20°C, 30°C
- No load



Upper measured points

- (1)~(4): 5% (H) from the top of interior
5% (D) and (W) from each corner
- (5): Center from each corner
5%(H) from the top of interior

Middle measured points

- (6)~(9): 5% (D) and (W) from each corner
1/2(H)
- (10): Center from each corner
1/2(H)

Lower measured points

- (11)~(14): 5%(H) from Bottom of interior
5%(D) and (W) from each corner
- (15): Center from each corner
5%(H) from Bottom of interior

<Temperature uniformity>

* Reference data

(Unit: °C)

Measured points		AT20°C						AT30°C					
		SV-20°C		SV-25°C		SV-30°C		SV-20°C		SV-25°C		SV-30°C	
		Temp.	Range	Temp.	Range	Temp.	Range	Temp.	Range	Temp.	Range	Temp.	Range
Upper	(1)	-23.1	±2.3	-26.0	±2.5	-29.9	±2.5	-21.9	±1.7	-24.9	±2.4	-29.0	±2.2
	(2)	-23.1	±1.9	-26.0	±2.1	-30.0	±2.4	-22.3	±1.6	-25.2	±2.3	-29.2	±2.2
	(3)	-21.3	±1.3	-24.8	±1.3	-28.9	±1.6	-20.6	±1.1	-23.9	±1.5	-28.5	±1.5
	(4)	-21.3	±1.2	-24.7	±1.3	-28.9	±1.5	-20.4	±0.9	-23.7	±1.6	-28.2	±1.4
	(5)	-21.7	±1.4	-24.7	±1.9	-28.6	±2.2	-20.5	±1.0	-23.7	±1.9	-28.0	±1.9
Middle	(6)	-22.6	±2.3	-26.3	±2.2	-30.5	±1.8	-21.7	±2.1	-25.2	±2.0	-29.8	±1.3
	(7)	-21.5	±2.2	-26.0	±2.4	-30.5	±2.0	-21.8	±2.4	-25.4	±2.3	-30.0	±1.5
	(8)	-20.7	±0.8	-24.5	±0.9	-28.9	±0.9	-19.7	±0.7	-23.4	±0.9	-28.4	±0.9
	(9)	-20.8	±0.9	-24.6	±1.1	-28.9	±1.1	-19.9	±0.8	-23.5	±1.2	-28.4	±1.0
	(10)	-21.7	±0.8	-25.4	±0.9	-29.8	±0.9	-20.7	±0.6	-24.4	±1.0	-29.2	±0.9
Lower	(11)	-20.7	±1.1	-24.5	±1.3	-28.7	±1.5	-19.9	±0.9	-23.4	±1.2	-28.2	±0.9
	(12)	-20.4	±0.8	-24.3	±1.0	-28.6	±0.8	-19.8	±0.8	-23.5	±0.9	-28.4	±0.8
	(13)	-20.1	±0.8	-23.9	±0.9	-28.2	±0.8	-19.4	±0.6	-23.0	±0.9	-28.0	±0.7
	(14)	-20.4	±0.8	-24.2	±1.0	-28.4	±0.9	-19.7	±0.8	-23.3	±1.0	-28.0	±0.9
	(15)	-21.4	±0.9	-25.2	±1.1	-29.5	±1.0	-20.7	±0.8	-24.3	±1.2	-29.2	±1.0
Accuracy		-1.7 °C		-0.4 °C		+0.2 °C		-0.7 °C		+0.6 °C		+0.8 °C	
Variation		-20 -0.1 °C -3.1		-25 +1.1 °C -1.3		-30 +1.8 °C -0.5		-20 +0.6 °C -2.3		-25 +2.0 °C -0.4		-30 +2.0 °C -0.0	
Amount of power consumption [kWh/day]		3.29		3.25		3.94		3.84		3.82		4.90	